

299-E33-40 (A4866) Log Data Report

Borehole Information:

Borehole: 299-E33-40 (A4866)		Site: 216-B-50 Crib			
Coordinates (WA State Plane)		GWL (ft)¹: 226.15	GWL Date: 11/26/2002		
North	East	Drill Date	TOC² Elevation	Total Depth (ft)	Type
137,723.1 m	573,546.23 m	Nov. 1991	191.39 m	318	Cable Tool

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Stainless steel	3.35	6 1/2	6 3/16	3/32	+3.35	Unknown
T304 stainless steel	0.9	4.25	4	0.125	+0.9	297.3
T304 stainless-steel screen		4.25	4	0.055	297.3	308.3
Casing information is from field measurements and data reported in the well construction and completion report. The 4-in. casing can't be reached for measuring because the 6-in. casing stick-up is too long. Casing bottom is as reported from the well construction and completion summary (Ledgerwood 1993) adjusted to TOC.						

Borehole Notes:

Borehole coordinates, elevation, and well construction information are from measurements by Stoller field personnel and Ledgerwood (1993). The depths have been adjusted to TOC. Zero reference is the top of the 6-in. casing. Surrounding the casing, the ground surface is a 3-ft x 3-ft x 6-in. concrete pad. According to Ledgerwood (1993), T304 stainless-steel 4-in. casing and screen were used in this borehole. An estimate of the screen thickness was obtained from John Auten, drilling engineer with CH2M Hill Hanford, Inc. An estimate of the casing thickness was based on prior measurements of T304 casing by Stoller logging engineers. The 6-in. casing appears to only be surface casing. Surface grout extends to 23.42 ft (Ledgerwood 1993). Below the grout, the borehole is sealed with bentonite to 234.2 ft, and cement grout from 234.2 to 284.5 ft. Between 283.9 and 289.4 ft, the casing is surrounded with bentonite chunks. Below the bentonite chunks, the screen is surrounded by silica sand to 308.2 ft. The logging engineer measured depth to water with an e-tape.

Logging Equipment Information:

Logging System:	Gamma 2B	Type:	SGLS (35%)
Calibration Date:	09/2002	Calibration Reference:	GJO-2002-384-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Logging System:	Gamma 2A	Type:	SGLS (35%)
Calibration Date:	10/2002	Calibration Reference:	GJO-2002-383-TAC
		Logging Procedure:	MAC-HGLP 1.6.5, Rev. 0

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2	3	4	5
Date	11/25/02	11/25/02	11/26/02	11/27/02	12/02/02
Logging Engineer	Spatz	Spatz	Spatz	Spatz	Spatz
Start Depth (ft)	92.0	17.0	176.0	227.0	308.0
Finish Depth (ft)	16.0	4.0	91.0	175.0	253.0
Count Time (sec)	200	200	200	200	200
Live/Real	R	R	R	R	R
Shield (Y/N)	N	N	N	N	N
MSA Interval (ft)	1.0	1.0	1.0	1.0	1.0
ft/min	N/A ⁴	N/A	N/A	N/A	N/A
Pre-Verification	BA172CAB	BA172CAB	BA173CAB	BA174CAB	BA175CAB
Start File	BA172000	BA172077	BA173000	BA174000	BA175000
Finish File	BA172076	BA172090	*BA173085	BA174052	BA175055
Post-Verification	BA172CAA	BA172CAA	None	BA174CAA	None
Depth Return Error (in.)	0	0	0	-1	N/A
Comments	Fine-gain adjustment after file BA172000.	Sonde was refilled with liquid N ₂ . No fine-gain adjustment.	Fine-gain adjustments after files: BA173000, -004, -005, & -012	No fine-gain adjustment.	No fine-gain adjustment.

Log Run	6	7	8/Repeat		
Date	12/02/02	12/04/02	12/04/02		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	254.0	247.0	225.0		
Finish Depth (ft)	246.0	226.0	194.0		
Count Time (sec)	200	200	200		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	1.0	1.0		
ft/min	N/A	N/A	N/A		
Pre-Verification	BA175CAB	BB155CAB	BB155CAB		
Start File	BA175056	BB155000	BB155022		
Finish File	BA175064	BB155021	BB155053		
Post-Verification	None	BB155CAA	BB155CAA		
Depth Return Error (in.)	-1	N/A	-1		
Comments	No fine-gain adjustment.	A fine-gain adjustment after file BB155005.	Repeat section. No fine-gain adjustment.		

Logging Operation Notes:

Zero reference was top of the casing. Logging was performed without a centralizer installed on the sonde. Pre- and post-survey verification measurements for the SGLS employed the Amersham KUT (⁴⁰K, ²³⁸U, and ²³²Th) verifier with serial number 082. During logging run 1, files BA173083, BA173084, and BA173085 were collected without a flow of liquid N₂. On 11/26/2002 and 12/02/2002, post surveys were not collected because the sonde de-energized automatically due to the loss of liquid N₂. The liquid N₂ dewar equipped on sonde A failed; consequently, the electronics carried on the sonde could not be energized. On 12/04/02, sonde A was replaced with sonde B. On 12/04/02, prior to logging run 7, two pre-

survey verifications were collected; the second file is named BB155BAB. The full-width at half-maximum value for the 609 and 1460-keV peaks are too broad and exceed the most recent acceptance criteria.

Analysis Notes:

Analyst:	Sobczyk	Date:	2/19/02	Reference:	GJO-HGLP 1.63, Rev. 0
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SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day. The verification spectra collected by Gamma 2A were all within the control limits that were established on 12/05/2002. All of the verification spectra collected by Gamma 2B were above the control limit for the 609-keV full-width at half-maximum value and 1461-keV full-width at half-maximum value. The peak counts per second (cps) at the 609-keV, 1461-keV, and 2615-keV photopeaks on the post-run verification spectra as compared to the pre-run verification spectra for each day were between 1 and 8 percent of one another. Examinations of spectra indicate that the detector functioned normally during all of the logging runs, and the spectra are provisionally accepted.

Log spectra for the SGLS were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in EXCEL (source files: G2AOct02.xls and G2Bfeb03.xls), using parameters determined from analysis of recent calibration data. Zero reference is the top of the casing. On the basis of Ledgerwood (1993) and the gross gamma response, the casing configuration was assumed to be one string of 6-in. surface casing to a log depth of 23.4 ft, one string of 4-in. casing to 297.3 ft, and 4-in. screen to the maximum depth of the log. Casing correction factors were calculated assuming a total casing thickness of 0.219 in. from 0 to 23.4 ft, 0.125 in. from 23.4 to 297.3 ft, and 0.055 in. from 297.3 to 308 ft (the measured values for these casing materials). Where more than one casing exists at a depth, the casing correction is additive (e.g., $0.0938 + 0.125 = 0.219$ would be the combined thickness for the 6-in. and 4-in. casings). A water correction was applied to the SGLS data below 226.15 ft. Dead time corrections were not needed because dead time did not exceed 10.5 percent.

Log Plot Notes:

Separate log plots are provided for gross gamma and dead time, naturally occurring radionuclides (^{40}K , ^{238}U , and ^{232}Th), and man-made radionuclides. Plots of the repeat logs versus the original logs are included. In addition, comparison log plots of man-made radionuclides are provided to compare the data collected by Westinghouse Hanford Company's Radionuclide Logging System (RLS) with SGLS data. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The ^{214}Bi peak at 609 keV was used to determine the naturally occurring ^{238}U concentrations on the combination plot rather than the ^{214}Bi peak at 1764 keV because it exhibited slightly higher net counts per second.

Results and Interpretations:

^{137}Cs and ^{60}Co were the man-made radionuclides detected in this borehole. ^{137}Cs was detected in the borehole near the ground surface (5.0 to 18.0 ft) with a maximum concentration of 2.1 pCi/g at a log depth of 6.0 ft. ^{137}Cs was also detected at 24 and 46 ft with concentrations near the MDL of 0.2 pCi/g. ^{60}Co was detected in the interval from 102.0 ft through 199.0 ft. The range of concentrations was from the MDL (0.1 pCi/g) to 0.7 pCi/g, which was detected at 107.0 ft.

Recognizable changes in the KUT logs occurred in this borehole. However, these changes are more indicative of the well completion materials than the surrounding formation. The KUT logs show significant changes at 24, 93, 233, 285, and 291 ft. These changes on the KUT logs are attributed to the change from cement grout to bentonite crumbles at 23 ft, the change from bentonite crumbles to bentonite slurry at 93 ft, the change to cement grout at 233 ft, bentonite chunks from 284 to 289 ft, and silica sand from 290 through 311 ft.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for both the man-made and natural radionuclides (661, 1173, 1333, 609, 1461, 1764, and 2614 keV). At 1460 keV, the repeat log (Gamma 2B sonde) appears to slightly underestimate ^{40}K concentrations as compared to the original log run (Gamma 2A sonde).

Comparison log plots of data collected in 1991 by Westinghouse Hanford Co. (WHC) and in 2002 by Stoller are included. The 1991 concentration data for ^{60}Co and ^{137}Cs are decayed to the date of the SGLS logging event in December 2002 and shifted from a ground level reference to a TOC reference. In 1991, the borehole was logged by WHC before the well was completed. On the 2002 logs, the apparent ^{60}Co profile is significantly different than the ^{60}Co profile observed in 1991. Over the interval where ^{60}Co was detected, the borehole was reported as 14 in. The 5-in. annulus of backfill should shield the formation and lead to a substantial reduction in ^{60}Co relative to the 1991 decayed values. The 1991 ^{60}Co values decayed, over the last 11 years, to 0.21. ^{60}Co concentrations below 142 ft are markedly higher than that predicted by decay alone when compared to the 1991 log. These changes in ^{60}Co profile over the last 10 years may have occurred in association with the well completion in 1991 or may be due to contaminant movement. Since 1991, ^{137}Cs activities appear to have decreased more than predicted by radioactive decay. The higher ^{137}Cs concentrations detected by the WHC RLS above 20 ft are due to the fact that the addition of grout shielded the later logging from the formation.

Because of this borehole's proximity to the significant vadose zone contamination attributed to the BY Cribs, it is recommended that this borehole is logged periodically to verify whether the changes observed in contaminant profile over the last 10 years have occurred in association with the well remediation in 1991 or from migration of contaminants through the vadose zone. The interval from 95 to 230 ft should be logged again in 1 year with the SGLS.

References:

Ledgerwood, R.K., 1993. *Summaries of Well Construction Data and Field Observations for Existing 200-East Resource Protection Wells*, WHC-SD-ER-TI-007, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

¹ GWL – groundwater level

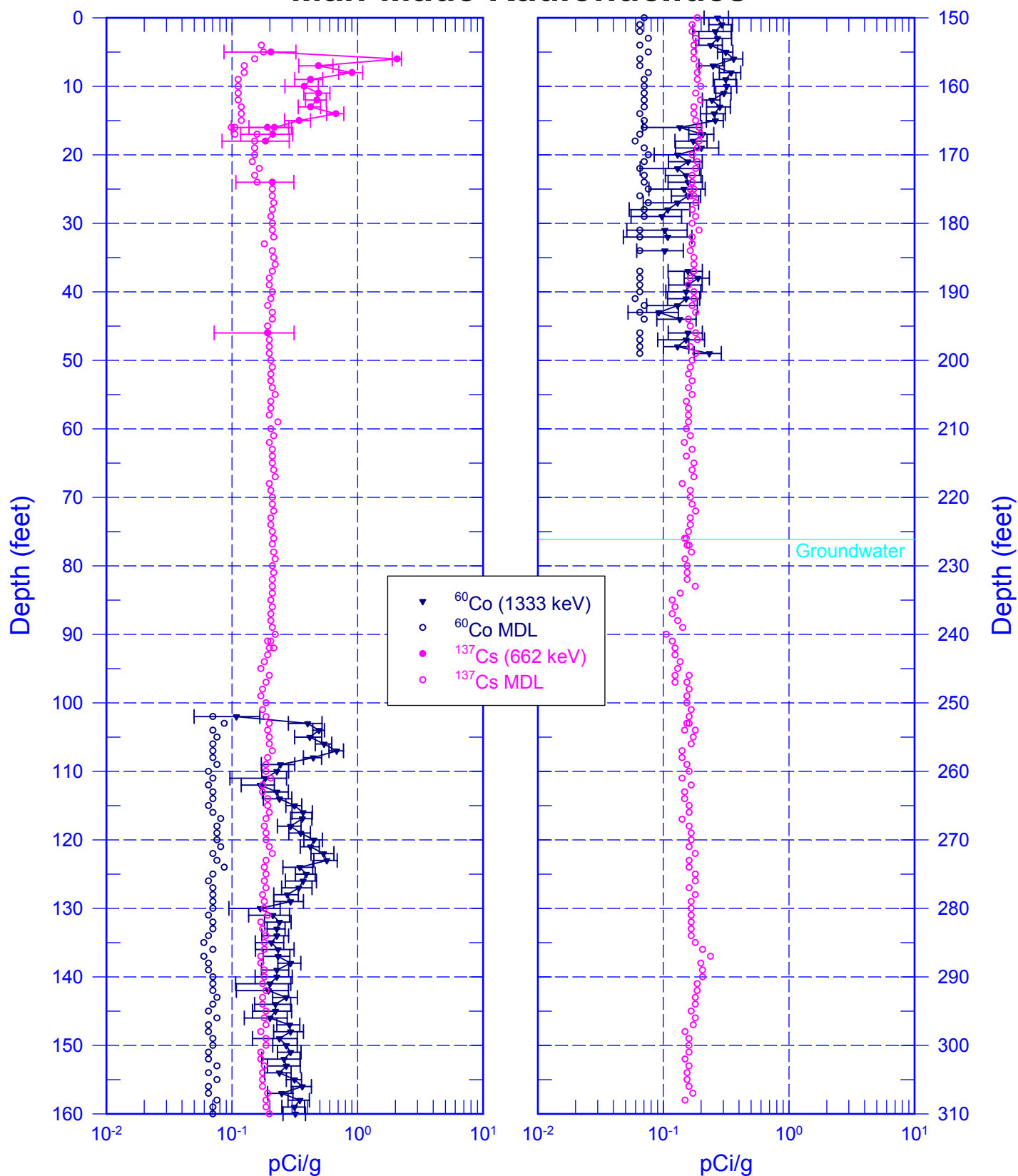
² TOC – top of casing

³ HWIS – Hanford Well Information System

⁴ N/A – not applicable

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Man-Made Radionuclides

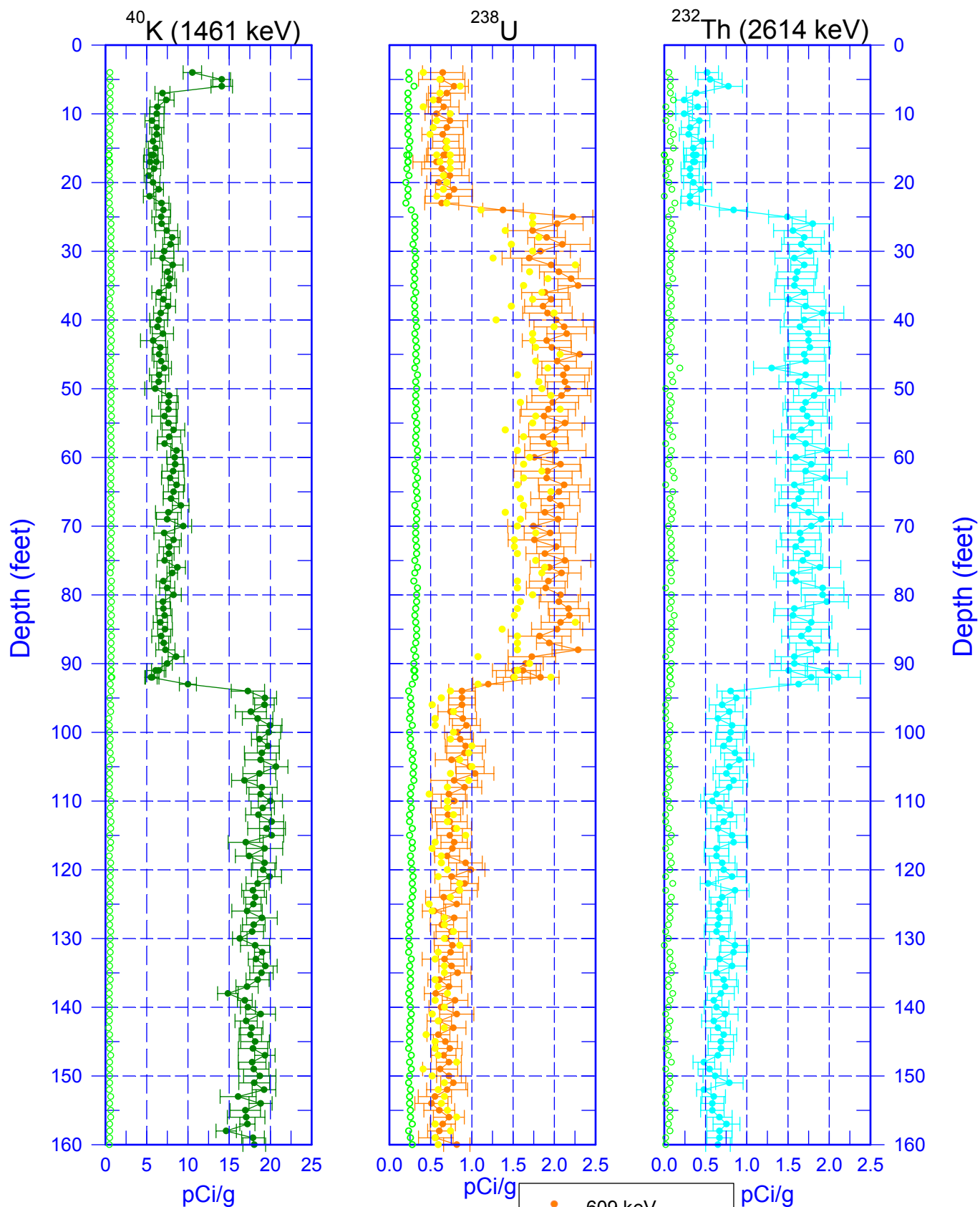


Zero Reference = Top of Casing

Date of Last Logging Run
12/04/2002

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Natural Gamma Logs

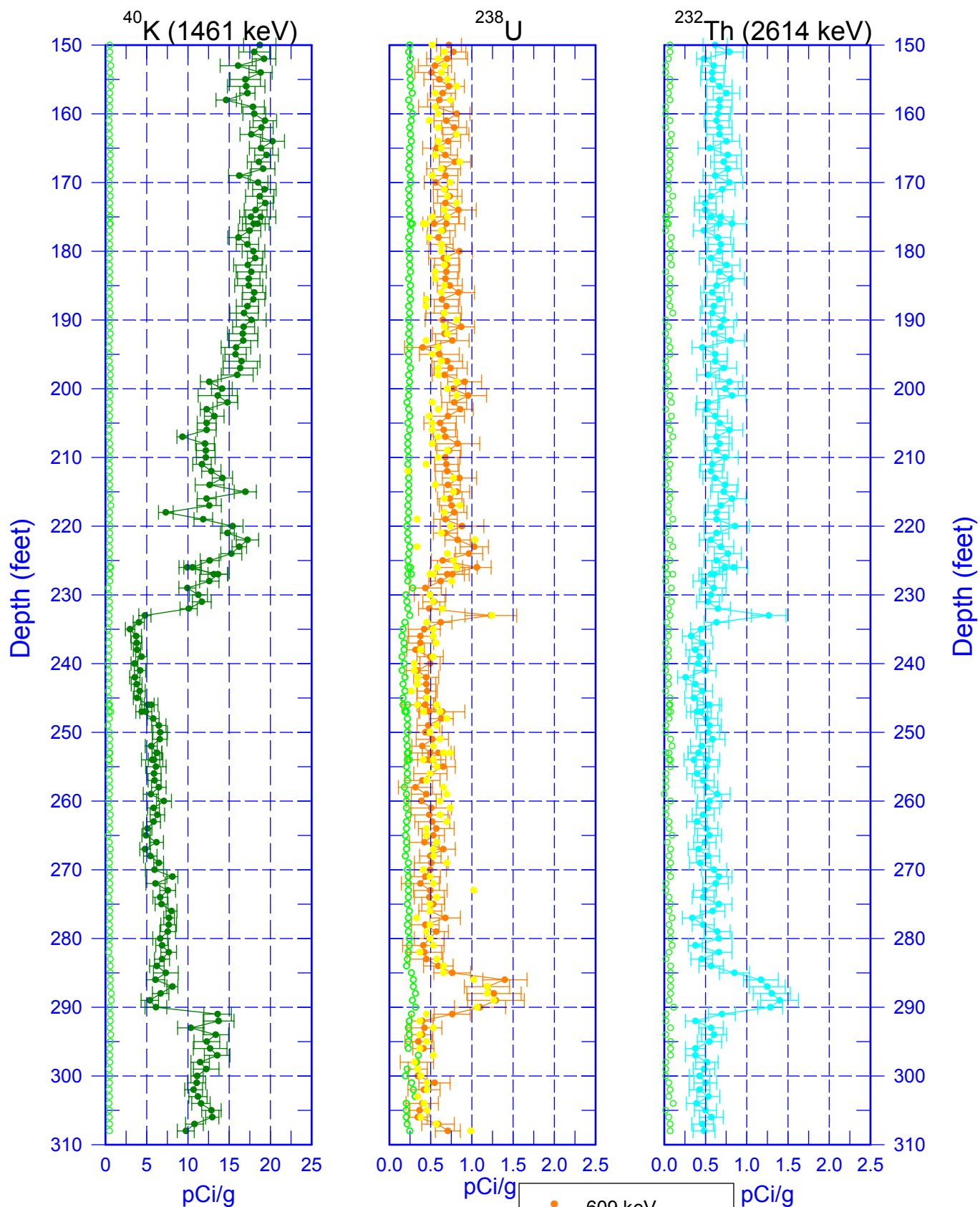


Zero Reference = Top of Casing

Date of Last Logging Run
12/04/2002

299-E33-40 (A4866)

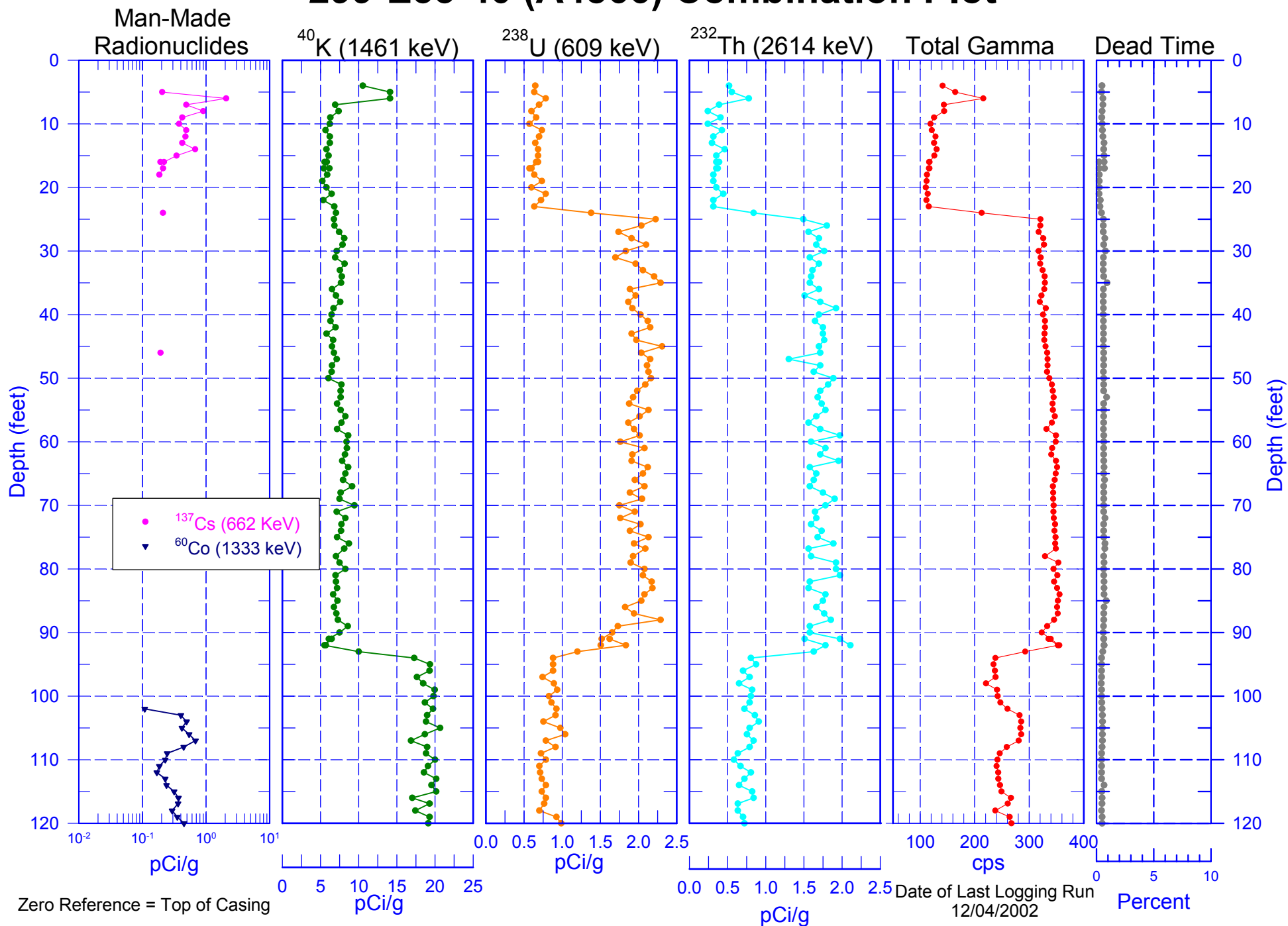
Natural Gamma Logs



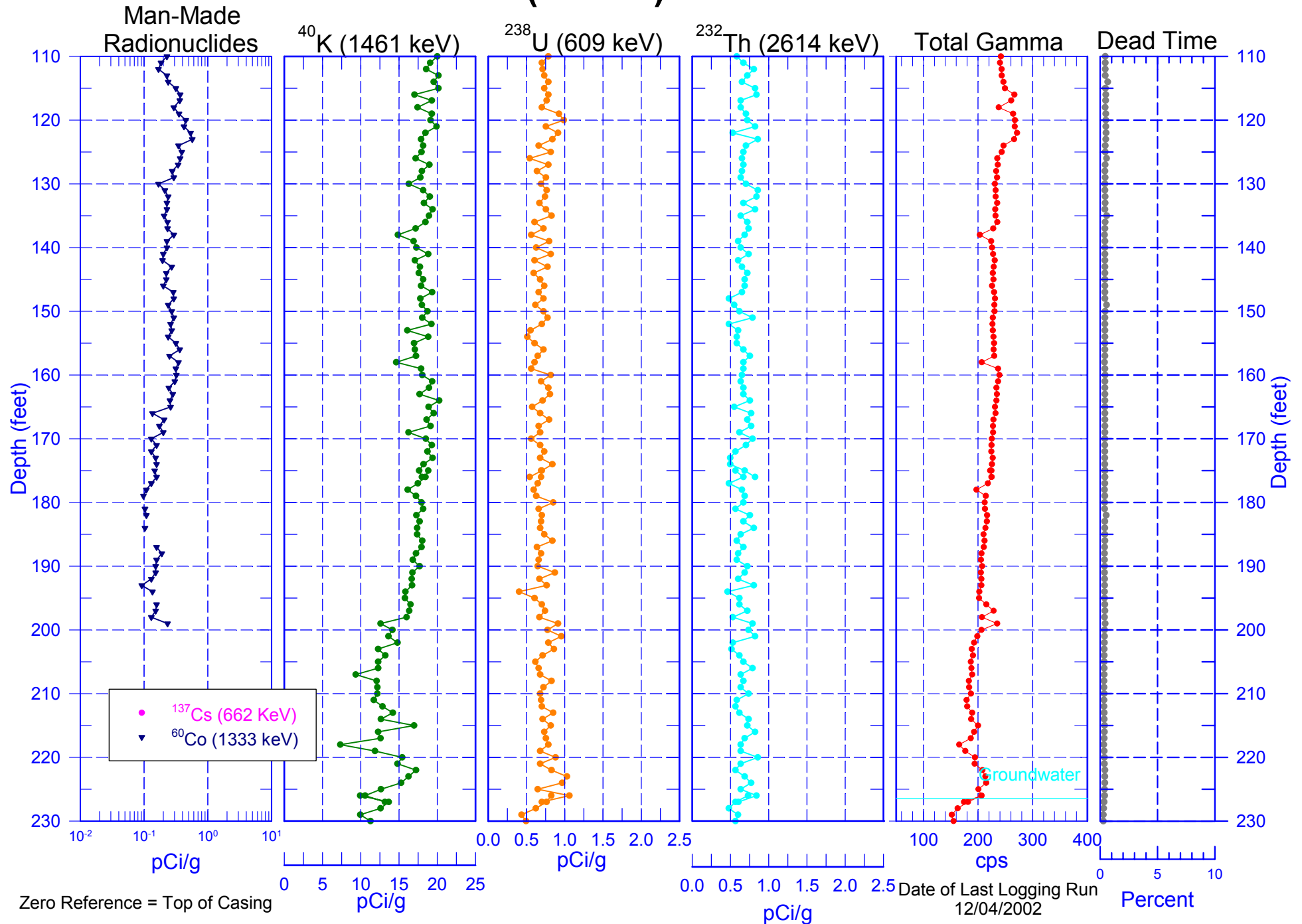
Zero Reference = Top of Casing

Date of Last Logging Run
12/04/2002

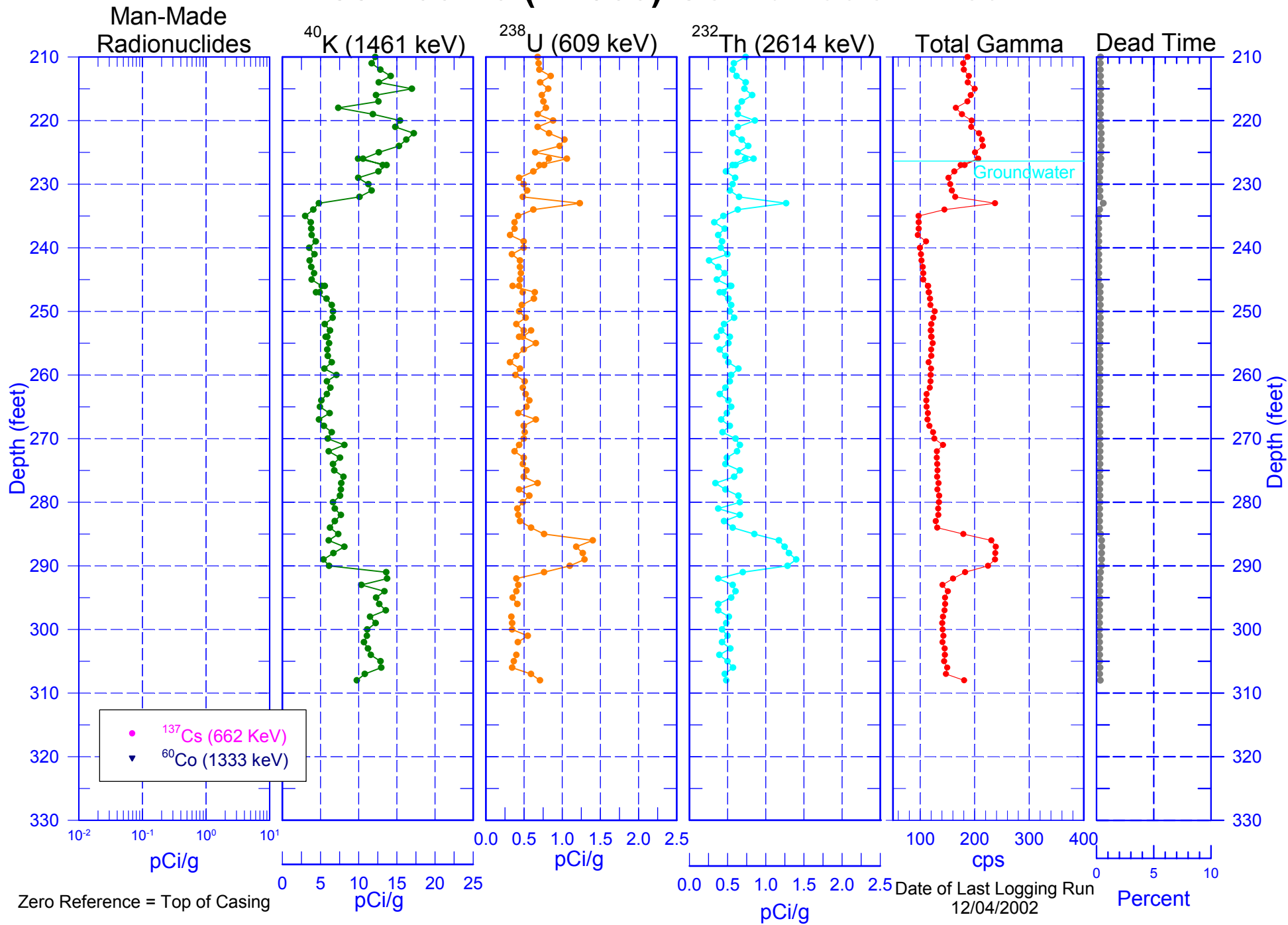
299-E33-40 (A4866) Combination Plot



299-E33-40 (A4866) Combination Plot

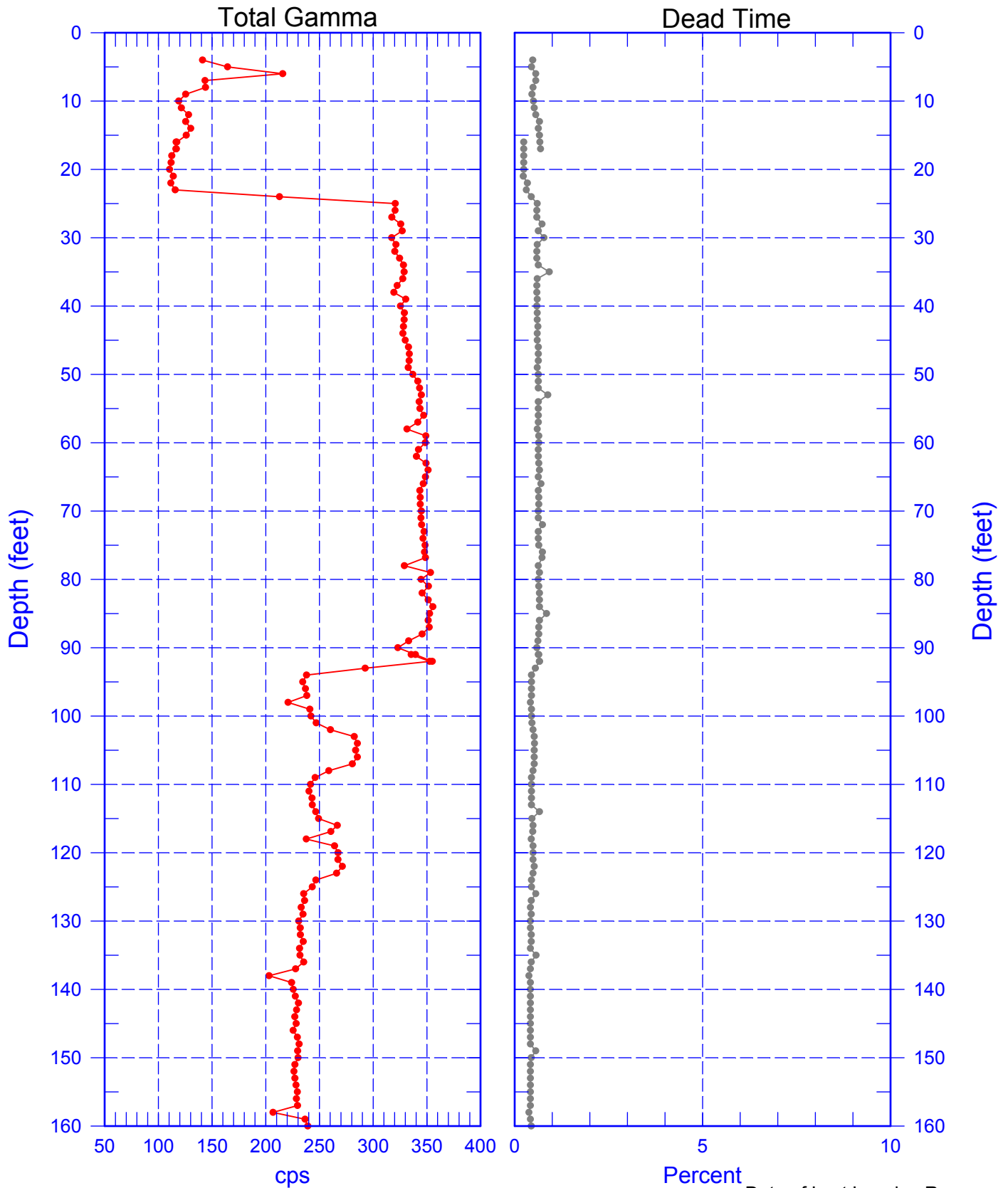


299-E33-40 (A4866) Combination Plot



299-E33-40 (A4866)

Total Gamma & Dead Time

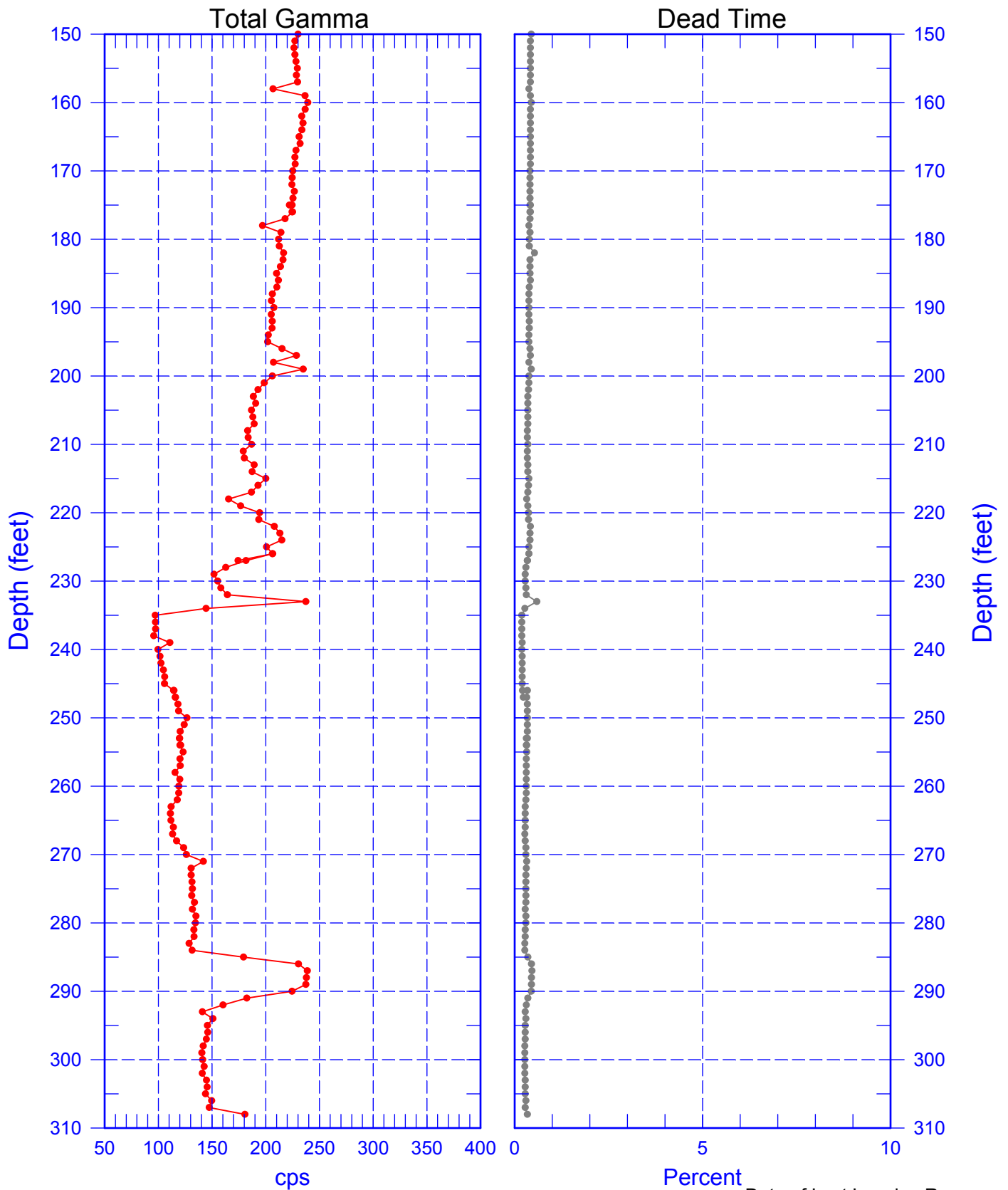


Zero Reference = Top of Casing

Date of Last Logging Run
12/04/2002

299-E33-40 (A4866)

Total Gamma & Dead Time

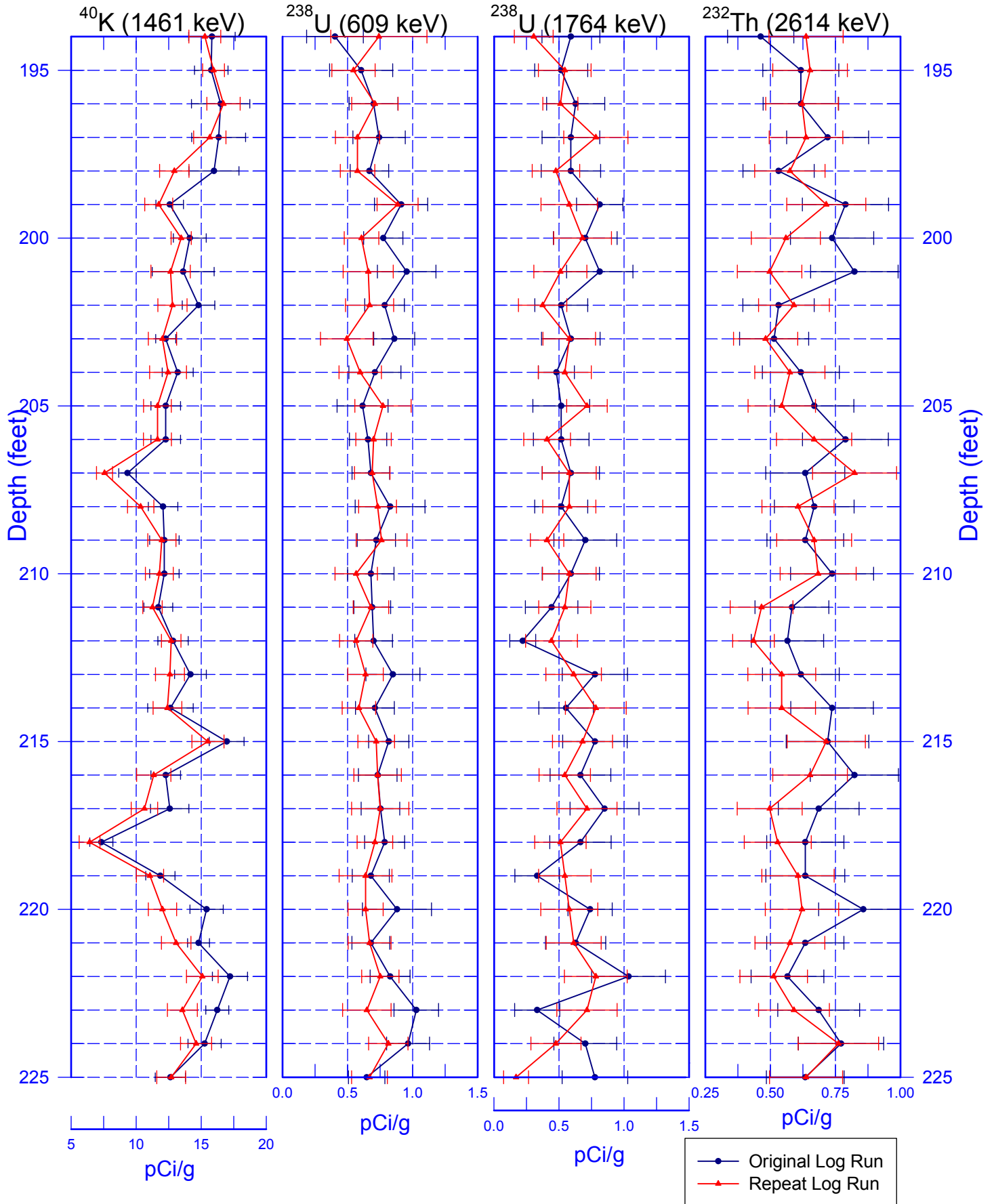


Zero Reference = Top of Casing

Date of Last Logging Run
12/04/2002

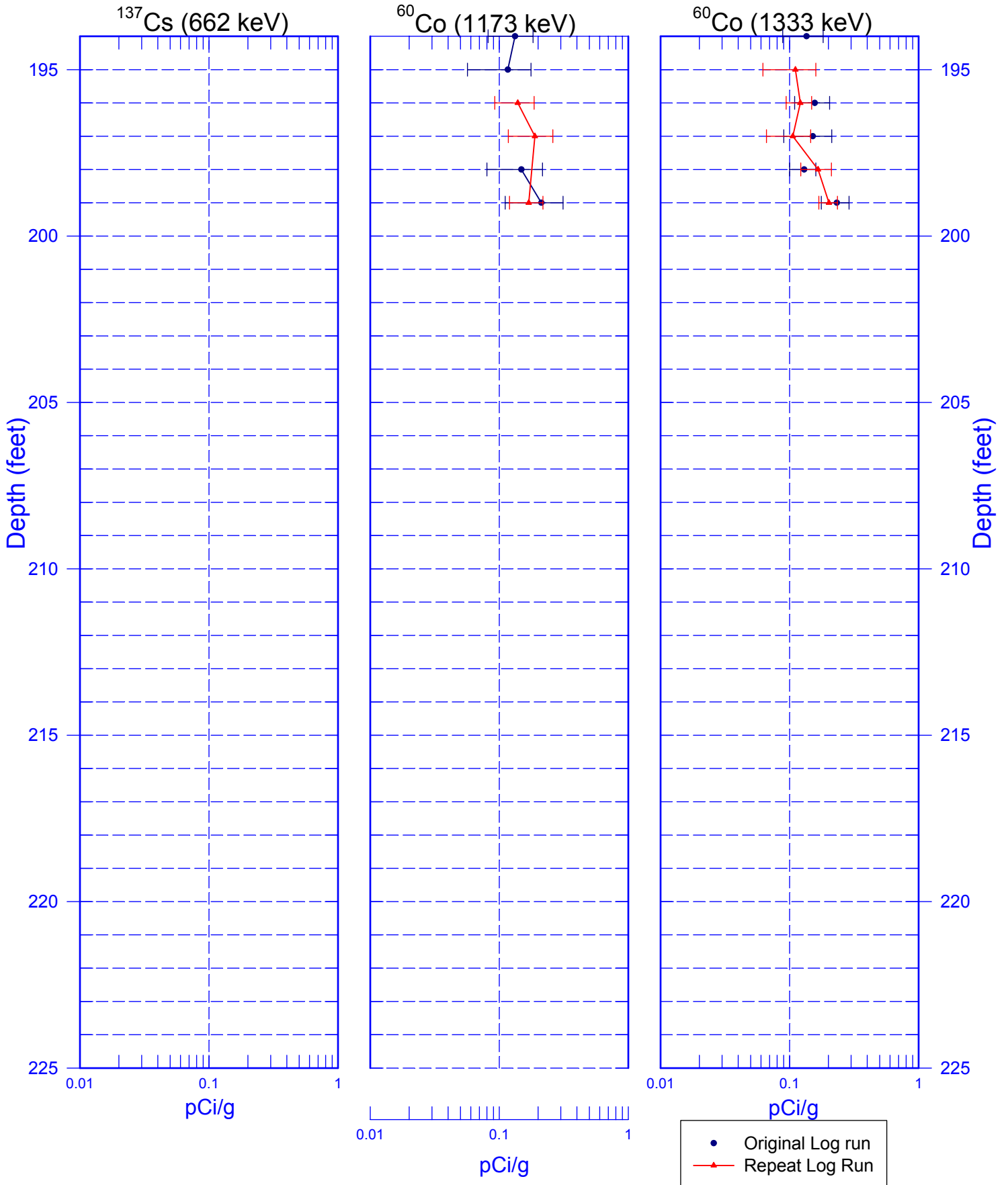
299-E33-40 (A4866)

Rerun of Natural Gamma Logs (225.0 to 194.0 ft)



299-E33-40 (A4866)

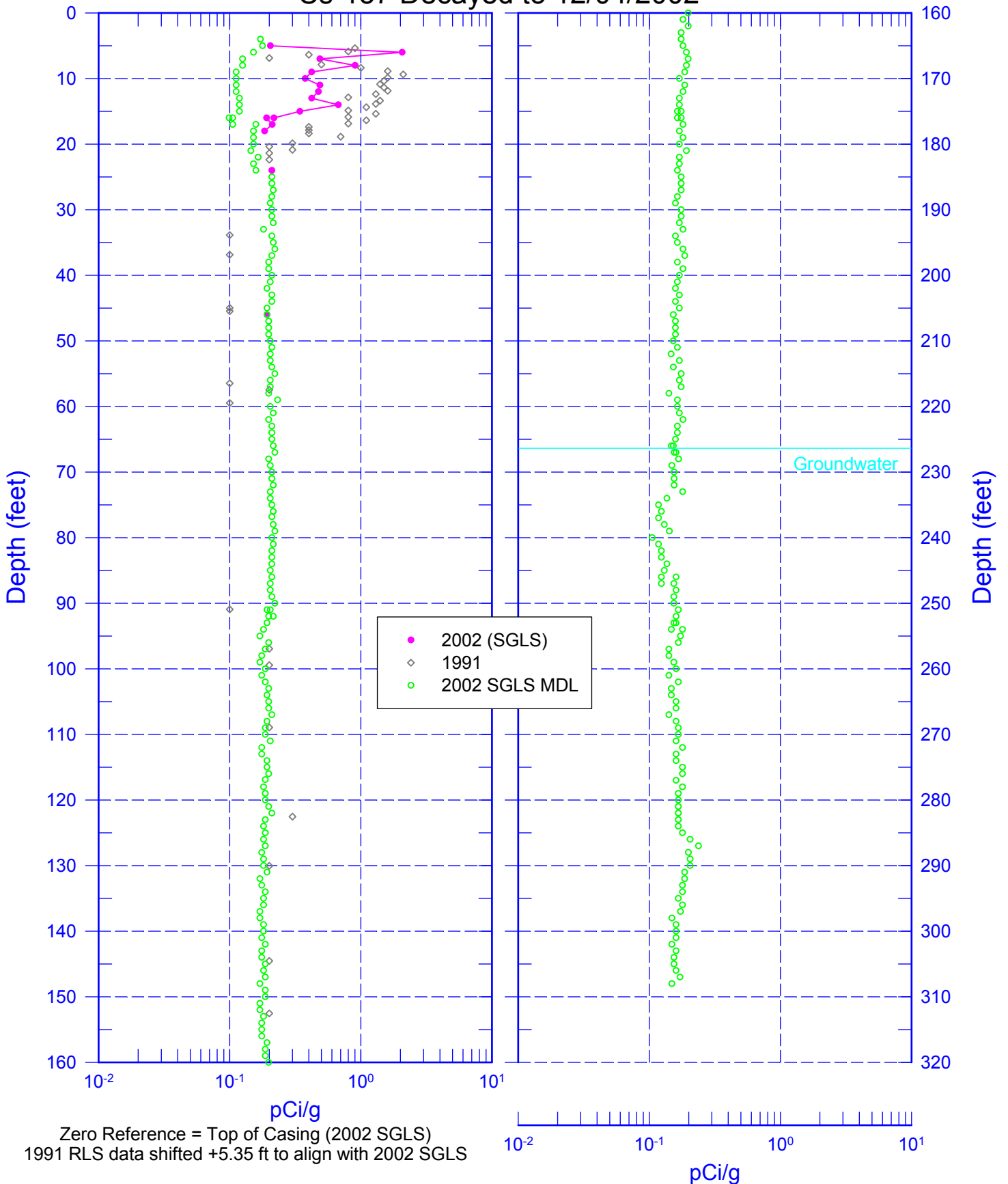
Rerun of Man-Made Radionuclides (225.0 to 194.0 ft)



299-E33-40 (A4866)

RLS Data Compared to SGLS Data

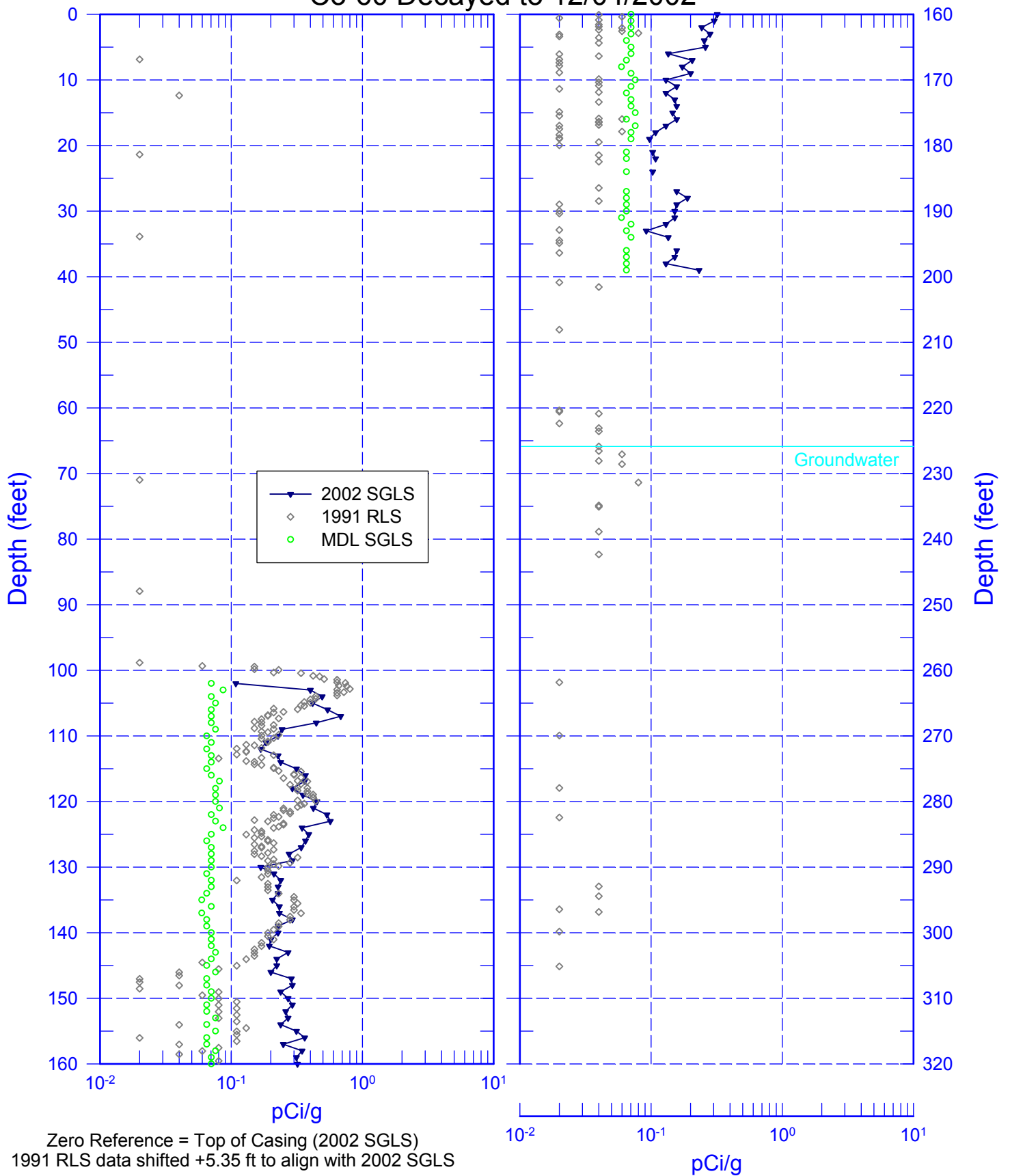
Cs-137 Decayed to 12/04/2002



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RLS Data Compared to SGLS Data

Co-60 Decayed to 12/04/2002



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Processed by Westinghouse 8/28/92

